



# MISSOURI DEPARTMENT OF NATURAL RESOURCES

## Handling and Processing of Anhydrous Ammonia Generators

Technical Bulletin

10/05

Field Services Division  
Environmental Services Program

**For Official Use Only**

### General Information

Missouri law enforcement, fire service and other emergency response officials continue to be involved with the seizure and cleanup of clandestine methamphetamine labs. Numerous hazards and health and safety risks are associated with clandestine methamphetamine labs. As attempts are made to “lock up” anhydrous ammonia and the risk of being caught stealing it increases an emerging trend involves the self-manufacture of anhydrous ammonia, aqueous ammonia or condensed ammonia by meth cooks.

Anhydrous ammonia is a common precursor used to manufacture methamphetamine using the Birch reduction or Nazi method. Anhydrous ammonia is one source of nitrogen fertilizer used in agriculture by row crop farmers and in many industrial refrigeration systems. Generally, anhydrous ammonia is obtained by the meth cooks by stealing it from nurse tanks or bulk tanks located at agricultural cooperatives, farm fields and from refrigeration systems at business and industry locations.

The first known anhydrous ammonia generator was located in November 2000, in a metal suitcase (Figure 1). In recent years the manufacturing process has progressed to plastic gasoline containers (Figure 2), then to metal air tanks (Figure 3), and most recently found in 20 pound propane tank (Figure 4). Anhydrous ammonia generators have also been discovered in other containers such as plastic buckets, fire extinguishers (Figure 5), canning jars, insulated coolers, and paint sprayers (Figure 6).



**Figure 1:** Suitcase



**Figure 2:** Gasoline can



**Figure 3:** Air Tank



**Figure 4:** Propane Tank



**Figure 5:** Fire Extinguisher



**Figure 6:** Paint Sprayer

The ingredients used in the self-manufacture of anhydrous ammonia are:

- Ammonia (which exists as a salt in over the counter fertilizers {ammonium nitrate, ammonium sulfate, etc.})
- Strong base (sodium hydroxide {Red Devil® Lye Drain Opener})
- Water or Hydrogen Peroxide

The mixing of these three ingredients in correct proportions coupled with the proper use of the following items will produce anhydrous ammonia:

- Cooling mechanism(s)
- Cooling agent(s): propane, acetone, denatured alcohol, methanol or dry ice
- Drying tube
- Condenser
- Tubing
- Capture/storage container

In addition to **corrosive hazards** associated with the sodium hydroxide and fertilizer there are **flammability hazards** of the cooling agents.

**Risk of burns from the heat** are possible where high temperatures (reported to be near 150°F) are also generated from the chemical reaction. Pressure (20 psi or greater) is also a concern in an active generator. The containers under **pressure can erupt violently and spray** their contents if lids are removed or otherwise disturbed resulting in serious injury or death



**Figure 7:** Propane Tank

(Figure 7). *Please Note:* Metal containers (propane tanks and air tanks) will not exhibit signs of pressure versus the more easily assessed “bulging” plastic gas containers.

An anhydrous ammonia generator should not be confused with the more common acid gas generator typically encountered at meth labs. Acid gas generators typically have a very low (acidic) pH (between 0 and 2). Anhydrous ammonia generators have an ammonia odor and typically have a high (basic/caustic) pH (>11). These extremes in pH are incompatible and If both types of generators are found at a meth lab they should **not** be packaged together in an overpack container for transport to a clandestine drug lab collection station.

## Anhydrous Ammonia Characteristics

The term “anhydrous” describes a compound that does not contain water. Since anhydrous ammonia contains no water, it is attracted to any form of moisture, including the human body. Anhydrous ammonia is gas under normal atmospheric temperature and pressure, however, when under pressure it is in liquid form. It is corrosive, and although placarded as a nonflammable gas, is flammable under certain conditions (flammable in the range of 15 - 25%

concentrations in air). When liquid anhydrous ammonia is released into the atmosphere it will expand 850 times in volume and can produce large toxic vapor clouds that may dissipate slowly. Anhydrous ammonia is slightly lighter than air and is highly soluble in water. It has a strong, penetrating, pungent odor.

### **Characteristics of Anhydrous Ammonia**

**Appearance:** Colorless alkaline gas and liquid

**Boiling Point:** -28° F

**Specific Gravity (water = 1):** 0.60 @ 68° F

**Solubility in Water:** Highly soluble

**Odor:** Penetrating pungent odor

**Odor Threshold:** 5 parts per million (ppm)

**Vapor Pressure:** 124 pounds per square inch (psi) @ 68° F

**Vapor Density (air = 1):** 0.60 @ 32° F

**Immediately Dangerous to Life and Health:** 300 parts per million



### **Personal Protective Equipment/Safety**

With the corrosivity of anhydrous ammonia and its affinity for moisture, it is extremely important to protect mucous membranes and skin from exposure. Exposure to anhydrous ammonia will cause severe burns to the skin, eyes, and respiratory tract. Because it is a strong alkali, anhydrous ammonia can cause **severe injury** to body tissue or **death** due to its caustic, freezing and dehydrating action that creates an almost instant freeze-drying process when it comes in contact with body tissue. An inhalation exposure to 300 parts per million (ppm) is considered “immediately dangerous to life and health” (IDLH). Brief exposure to concentrations of 2,500 to 2,600 ppm can result in death.

To the extent practical, exposure should be avoided by remaining upwind of anhydrous ammonia generators. To prevent direct exposure from an uncontrolled release when handling containers, approach the container from upwind, never stand or place your face over the container and cover the container with a heavy blanket or secured tarp.

Personal protective equipment (PPE) must always be worn when handling anhydrous ammonia generators. Minimum PPE should include a face shield, goggles or a full-face air-purifying respirator, rubber gloves with thermal lining, long pants and a heavy-duty long-sleeved shirt or coveralls.

Clothing contaminated with anhydrous ammonia should be removed as soon as possible and placed in a closed airtight container.

When anhydrous ammonia concentrations are unknown or above the IDLH level, a self-contained breathing apparatus (SCBA) and a fully encapsulated chemical resistant suit must be worn. In these circumstances, **contact your local hazardous materials response team and the Missouri Department of Natural Resources’ Environmental Emergency Response (EER) at (573) 634-2436** for assistance. The Department of Natural Resources (EER) telephone number is answered 24 hours a day, 7 days a week.

Refer to the ***National Institute for Occupational Safety and Health's*** (NIOSH) publication titled ***"Recommendations for Chemical Protective Clothing"*** and other reference materials provided by PPE manufacturers, in determining appropriate selection of PPE.

## **Packaging and Transporting of Generators**

If an anhydrous ammonia generator is encountered at a meth lab, if needed, allow time for the chemical reactions occurring inside the generator to go completion and then release all pressure prior to transport. To reduce pressure and vapor hazards the generator may need to be devalved or decommissioned, prior to being transported. The Missouri Department of Natural Resources' "Technical Bulletin of Safe Handling and Destruction of Containers of Anhydrous Ammonia" may be use as a reference to decommissioning. However **during any decommissioning it is recommended** the placement of projectiles for anhydrous ammonia generators **should only be located near the top of the generator** (versus that which is recommended in the technical bulletin for decommissioning containers of anhydrous ammonia). Decommissioning by only placing a hole in the container above the liquid level, reduces the chance of corrosive liquids being spilled to the environment.

Once the anhydrous ammonia generator is safe to transport it should be packaged in an overpack container. A 5-gallon bucket with loosely secured screw-top lid may be used, however, other types and sizes of overpack containers may be used. A loosely secured lid will allow any pressure to escape, pressures that may have been produced during agitation of the generator during transport. Packing material (kitty litter, sand, oil dry, etc.) should be added inside the overpack container to surround but not cover the generator. This material will help keep the container from shifting during transport. Nothing should be added, such as neutralizing agent or packing material, to the contents of the generator. The overpack container should be secured/fastened in the vehicle to prevent shifting during transport. The overpack container should be transported in a vehicle that has a cargo area separate from the driver and passenger area (e.g. pickup truck, trailer).

The driver and passenger(s) must be ready to move upwind in case a generator releases ammonia vapor. To the extent possible, travel routes should avoid highly populated areas. The use of shipping papers and affixing oxidizer and corrosive labels to the overpack container are strongly recommended.

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